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(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PURPOSE: To improve the transmittance of the liquid crystal display device and to allow black and white and color displaying as well s to improve a contrast ratio by providing a polarizing plate and phase plate or either one thereof between a pair of substrates, more preferably on the inner side of the liquid crystal element, i.e. on the inner side of an electrode.

CONSTITUTION: The liquid crystal 5 is crimped between the glass substrates 2 and 10 and the polarizing plate 1 is disposed on the outer side of the glass substrate 2. The polarizing plate 8 is disposed between the lower electrode 9 and an oriented film 6 and further, the phase plate 7 is disposed between the polarizing plate 8 and the oriented film 6 so that the display colors of the liquid crystal display device can be changed. While the upper electrode 3 is a transparent electrode, the lower electrode 9 may not be transparent and may be

commonly used as a reflecting plate. The liquid crystal display device having time-divided driving characteristics has the low transmittance and is not suitable for a reflection type but its transmittance is enhanced and further, the contrast ratio is improved by providing the phase plate 7 between a pair of the substrates 2 and 10, more preferably on the inner side of the electrode 9.

CLAIMS

[Claim(s)]

[Claim 1]When it is the magnetic tape which has a continuous thin film type magnetic layer which contains a Co base alloy as the main ingredients on a long nonmagnetic base, width of said nonmagnetic base is 7 mm or less and tension of 40g or less per mm in width is impressed in the length direction, Magnetic tape, wherein a crack which connects crosswise both ends of said magnetic layer does not occur.

[Claim 2]It is the magnetic tape which has a continuous thin film type magnetic layer which contains a Co base alloy as the main ingredients on a long nonmagnetic base, Magnetic tape which a ground film is formed in a magnetic layer side surface for said nonmagnetic base at 7 mm or less in width, and is characterized by moisture transmission quantity in 60 ** after ground film formation and 90%RH being 60 g/m^2 and 24 hr or less.

[Claim 3]The magnetic tape according to claim 2 which a crack which connects crosswise both ends of said magnetic layer does not generate when tension of 40g or less per mm in width is impressed in the length direction.

[Claim 4]The magnetic tape according to any one of claims 1 to 3 in which said magnetic layer comprises at least a two-layer ferromagnetic metallic thin film

formed by slanting vacuum deposition.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to improvement of magnetic tape with narrow width.

[0002]

[Description of the Prior Art]Saturation magnetic flux density is large, and moreover, since coercive force is high, the magnetic recording medium using the ferromagnetic metallic thin film which is carrying out densification of the magnetic recording medium increasingly in recent years, made Co the subject

especially, and added nickel etc. is studied briskly.

[0003]Although this type of magnetic recording medium is manufactured by various methods, laminating a ferromagnetic metallic thin film more than two-layer with slanting vacuum deposition, and considering it as multilayer structure on a nonmagnetic base, as an especially outstanding method, is proposed. In slanting vacuum deposition, the steam of ferromagnetic metal is dispatched at a specific angle on the surface of a nonmagnetic base, By this. The columnar-grain child of ferromagnetic metal. it is made to grow up in the specific direction which intersected the growth direction of the columnar-grain child of other ferromagnetic metallic thin films (JP,56-26891,B, 56-42055, 63-21254 and 60-37528, JP,54-603,A, 54-147010, 56-94520, and 57-3233.) 57-30228, 57-13519, 57-141027, 57-41028, 57-141029, 57-143730, 57-143731, 57-147129, 58-14324, 58-50628, 60-76025, 61-110333, 61-187122, 63-10315, 63-10315, 63-13117, 63-14317, 63-14320, the 63 No. -39127 gazette, etc. Thereby, coercive force, other magnetic parametric performances, or a mechanical characteristic improves.

[0004]The magnetic recording medium which has the ferromagnetic metallic thin film formed by slanting vacuum deposition is used as videotape of an 8mm camcorder method. although the width of the videotape for 8mm camcorder methods is 8 mm, it is possible for storage density to improve by improvement in

art, and to consider it as the tape whose width is still narrower by progress of the information-compression art in the case of a digital recording, etc.

[0005]However, since the crack generation of a magnetic layer increases remarkably when tape width is narrowed with 7 mm or less, a problem arises in reliability. Although the crack of a magnetic layer is generated by tension impression at the time of using it mainly with VCR, the crack generated in the magnetic layer of a tape with narrow width at this time has many which connect the crosswise both ends of a magnetic layer. If a big crack occurs, as a magnetic parametric performance, an output and the fall of S/N will arise and remarkable corrosion will occur from a crack in respect of physical properties. In the case of the crack especially covering the crosswise whole region, the magnetic layer exfoliation from a tape edge part occurs, and it becomes a big cause of a run stop.

[0006]Therefore, in order to put magnetic tape with narrow width in practical use, it is required to carry out generating of a crack which was described above on **, but the effective proposal for it is not made.

[0007]

[Problem(s) to be Solved by the Invention]This invention is made from such a situation and width aims at preventing generating of the crack which connects the crosswise both ends of a magnetic layer in the magnetic tape which provided

the continuous thin film type magnetic layer in a long nonmagnetic base surface of 7 mm or less.

[0008]

[Means for Solving the Problem]Such a purpose is attained by this invention of following the (1) - (4).

[0009](1) When it is the magnetic tape which has a continuous thin film type magnetic layer which contains a Co base alloy as the main ingredients on a long nonmagnetic base, width of said nonmagnetic base is 7 mm or less and tension of 40g or less per mm in width is impressed in the length direction, Magnetic tape, wherein a crack which connects crosswise both ends of said magnetic layer does not occur.

[0010](2) It is the magnetic tape which has a continuous thin film type magnetic layer which contains a Co base alloy as the main ingredients on a long nonmagnetic base, Magnetic tape which a ground film is formed in a magnetic layer side surface for said nonmagnetic base at 7 mm or less in width, and is characterized by moisture transmission quantity in 60 ** after ground film formation and 90%RH being 60 g/m^2 and 24 hr or less.

[0011](3) Magnetic tape given in the above (2) which a crack which connects crosswise both ends of said magnetic layer does not generate when tension of 40g or less per mm in width is impressed in the length direction.

[0012](4) Magnetic tape the above (1) which comprises at least a two-layer ferromagnetic metallic thin film in which said magnetic layer was formed by slanting vacuum deposition thru/or given in either of (3).

[0013]

[Function]In order that the continuous thin film type magnetic layer which is used for the 8mm camcorder etc. and in which high density recording is possible may use Co as the main ingredients, it is very easy to oxidize, and corrosion advances especially easily from the nonmagnetic base side. The moisture and oxygen which this penetrates a nonmagnetic base and invade into a magnetic layer are the cause.

As for a nonmagnetic base, since these invade into a ferromagnetic metallic thin film from a base surface including moisture or oxygen, these also usually become a cause.

[0014]If Co base alloys, such as Co-nickel, oxidize, they will embrittle, and they become easy to generate a crack. Since the adhesion force to the nonmagnetic base of a magnetic layer will decline if it oxidizes, a crack generation increases also by this.

[0015]In this invention, in order to prevent oxidation of the magnetic layer which are the main causes of a crack, a ground film is provided in the magnetic layer

side surface of a nonmagnetic base. With this ground film, the moisture content which penetrates a base and a ground film is set to 60 g/m^2 and 24 hr or less in 60 ** and 90%RH, and the water penetration from a nonmagnetic base to a magnetic layer is suppressed, and invasion of oxygen is also controlled. For this reason, when oxidation of the magnetic layer of a Co base alloy is prevented and it drives with VCR, It does not generate, but even when a tape with a narrow width of 7 micrometers or less is used, high endurance is obtained, and reliable magnetic recording is possible for a big crack which connects the crosswise both ends of a magnetic layer even when the tension of 40 g per tape width of 1 mm is impressed in the tape length direction. When the usual VCR is used, the tension exceeding the above-mentioned value is not added to magnetic tape.

[0016]Oxidation of a magnetic layer advances [not only the nonmagnetic base side but] also from the side face direction of a magnetic layer. Since the size of a crystal grain can be made smaller than the ferromagnetic metallic thin film of the monolayer of the same thickness if a magnetic layer is made into the laminated constitution of the ferromagnetic metallic thin film more than two-layer, the oxidation resistance of a magnetic layer can improve and the oxidation from the magnetic layer side can be prevented.

[0017]

[Elements of the Invention]Hereafter, concrete composition of this invention is

explained in detail.

[0018][Nonmagnetic base] It is 7 mm or less, the width of a nonmagnetic base used by this invention can prevent generating of a crack covering overall width of a magnetic layer, even when a nonmagnetic base with such narrow width is used according to this invention, and even if it is 6 mm or less in width further, it can prevent generating of such a crack. Although there is no minimum in particular of width of a nonmagnetic base, it is usually not less than 3 mm.

[0019]What is necessary is just to determine thickness of a nonmagnetic base suitably according to intensity needed, restriction of a diameter when it winds, etc., and it is not limited in particular. However, since width of a nonmagnetic base is narrowly set up as mentioned above in this invention, comparable intensity is obtained even if it makes thickness thin compared with a wide nonmagnetic base. For this reason, thickness of a nonmagnetic base can be 3-7 micrometers, and can be especially stored in a smaller cassette half 8 micrometers or less, for example.

[0020]Although there is no restriction in particular in construction material of a nonmagnetic base and various films which bear heat at the time of ferromagnetic metallic thin film vacuum evaporation, for example, polyethylene terephthalate, polyethylenenaphthalate, aramid, polyimide, etc. can be used, It is preferred to use polyethylenenaphthalate especially with low water content and moisture

transmission quantity, aramid, polyimide, etc. However, in this invention, since invasion of moisture to inside of a magnetic layer or oxygen can be prevented with a ground film, moisture and comparatively high polyethylene terephthalate of oxygen permeability can be used, and magnetic tape of this invention is obtained by low cost.

[0021][Ground film] A ground film is provided between a magnetic layer side surface of a nonmagnetic base, i.e., a nonmagnetic base, and a magnetic layer.

[0022]this invention -- moisture transmission quantity of a nonmagnetic base after ground film formation -- 60 ** and 90%RH -- 60g/m^2- 24 or less hr is preferably set to 40 g/m^2 and 24 hr or less. Although moisture transmission quantity in this invention is measured according to a cup method specified to JIS Z 0208 (1978), temperature and relative humidity at the time of measurement are set to 60 ** and 90%RH. If moisture transmission quantity exceeds said range, an antioxidant effect of a magnetic layer will become insufficient.

[0023]If the quality of a component of a ground film can be made into the above-mentioned moisture transmission quantity, there will be no **** in particular. However, since magnetic tape of this invention performs high density recording to a continuous thin film type magnetic layer, surface nature is good and it is preferred that it is a thin film.

[0024]As such a ground film, various inorganic thin films, such as various plasma

polymerization films, an oxide, a nitride, carbide, or various coating films are preferred.

[0025]What is necessary is just to choose thickness of a ground film so that the above-mentioned moisture transmission quantity may be obtained in consideration of the quality of a component. For example, when using the above-mentioned desirable construction material, it is preferred 100-2000A, and to be referred to especially as 300-1000A. Predetermined moisture transmission quantity is hard to be obtained with thickness of a ground film being less than said range, and if said range is exceeded, productivity will fall.

[0026]When it comprises a ferromagnetic metallic thin film more than two-layer so that a magnetic layer may mention later, a ground film described above also between adjacent ferromagnetic metallic thin films may be provided.

[0027][Magnetic layer] A magnetic layer formed on a nonmagnetic base is a continuous thin film type thing which contains a Co base alloy as the main ingredients.

[0028]As a Co base alloy, an alloy which contains Co in more than 60 atom % is preferred, and Co-Ni alloy, a Co-nickel-Cr alloy, Co-Cr alloy, etc. are preferred.

[0029]As for Co-Ni alloy and a Co-nickel-Cr alloy, being formed by slanting vacuum deposition is [among these] preferred.

[0030]What is necessary is just to adopt arbitrary things from inside of them,

since a slanting evaporation apparatus and a method are indicated in various kinds of articles shown above.

[0031]Slanting vacuum deposition, mating and sending a nonmagnetic base of the shape of a long film which it let out from a supply roll for example, to the surface of a rotating cooling drum. Metal is evaporated from a fixed metal source more than a piece, metal is vapor-deposited from an oblique direction to a normal of a nonmagnetic base, and it rolls round to a winding roll. In this case, an incidence angle changes continuously from maximum incident angle thetamax in early stages of vacuum evaporation to last minimum incident angle thetamin. If Co-Ni alloy and a Co-nickel-Cr alloy are vapor-deposited with such slanting vacuum deposition, a ferromagnetic metallic thin film in which a columnar-grain child grew up to be an arc will be formed.

[0032]It is preferred to use such a ferromagnetic metallic thin film as a magnetic layer laminated more than two-layer in this invention. In this case, compared with a magnetic layer of the same thickness that consists of a ferromagnetic metallic thin film of a monolayer, a path of a columnar-grain child of each ferromagnetic metallic thin film can be made small, for example to about 40 to 80%. A path of a columnar-grain child in this case is a columnar-grain child's diameter in the thickness direction halfway point of a ferromagnetic metallic thin film. Since it will become precise [a ferromagnetic metallic thin film] if a columnar-grain child's

path becomes small, tolerance over oxidation from the side improves. When it constitutes a magnetic layer from a ferromagnetic metallic thin film more than two-layer, it carries out by usually repeating the above-mentioned process of slanting vacuum evaporation.

[0033]When it constitutes a magnetic layer from a ferromagnetic metallic thin film more than two-layer, it is preferred to constitute lower than Co content of a ferromagnetic metallic thin film of the top layer Co content of a ferromagnetic metallic thin film of the bottom of the heap. It is because high oxidation resistance will be acquired if Co content is low (i.e., if content of nickel, or nickel and Cr is high).

[0034]And a large frequency band is covered in this case, and a good magnetic parametric performance comes to be acquired. This reason is as follows.

[0035]generally until record is deeply carried out by more nearly low-pass signal, and a high band signal is recorded on a magnetic layer of a magnetic recording medium by shallow field. And coercive force declines, so that a ferromagnetic metallic thin film which uses Co as the main ingredients has low Co content. Therefore, if Co content of the top layer is made higher than Co content of the bottom of the heap, since high coercive force is acquired in the top layer, the magnetic parametric performance of a high band signal becomes good, and since low coercive force is acquired in the bottom of the heap, the magnetic

parametric performance of a low-pass signal will become good.

[0036]As for Co content of a ferromagnetic metallic thin film of the bottom of the heap, it is preferred 70-85atom% and that it is 74-80atom% especially. If Co content of the bottom of the heap becomes in said less than range, coercive force needed for the bottom of the heap will be hard to be acquired, and if said range is exceeded, corrosion resistance needed for the bottom of the heap will be hard to be acquired. As for Co content of a ferromagnetic metallic thin film of the top layer, it is preferred 75-90atom% and that it is 79-85atom% especially. If Co content of the top layer becomes in said less than range, coercive force needed for the top layer will be hard to be acquired, and if said range is exceeded, corrosion resistance needed for the top layer will be hard to be acquired.

[0037]When making a magnetic layer into multilayered constitution, it is preferred that a ferromagnetic metallic thin film of the bottom of the heap is vapor-deposited in thetamax smaller than thetamax at the time of ferromagnetic metallic thin film vacuum evaporation of the top layer. Since this invention persons have low deposition efficiency in a portion in which ferromagnetic metal entered near 90 thetamax(es) (i.e., a nonmagnetic base surface) and into parallel as a result of repeating an experiment, It found out that a columnar-grain child's path became small and an opening had produced between each particle,

oxygen and moisture of the nonmagnetic group inside of the body invaded from this opening, and the knowledge of corrosion advancing was carried out. If the bottom of the heap is vapor-deposited in the above thetamax(es), generating of said opening can be suppressed, and a magnetic recording tape whose corrosion resistance is very good is obtained. Since openings decrease in number, a filling factor of ferromagnetic metal in a magnetic layer improves, and high saturation magnetization is obtained.

[0038]And if the bottom of the heap is vapor-deposited in small thetamax, low coercive force will be acquired, and a magnetic parametric performance about a low-pass signal recorded mainly on the bottom of the heap improves. Since thetamax at the time of top layer vacuum evaporation becomes larger than thetamax at the time of bottom-of-the-heap vacuum evaporation, in the top layer, high coercive force is acquired and its magnetic parametric performance of a high band signal improves. Therefore, high corrosion resistance is acquired and a high magnetic parametric performance is acquired in a wide band. In this case, as for especially thetamax at the time of top layer vacuum evaporation, it is preferred that it is 85 to 90 degrees 80 to 90 degrees, and, as for especially thetamax at the time of bottom-of-the-heap vacuum evaporation, it is preferred that it is 60 to 84 degrees 31 to 89 degrees.

[0039]Even when a ferromagnetic metallic thin film of the top layer is

vapor-deposited by larger thetamin than thetamin at the time of ferromagnetic metallic thin film vacuum evaporation of the bottom of the heap, an effect of this invention improves further. thetamin also participates in a columnar-grain child's inclination, and if thetamin is large, since a columnar-grain child's average inclination becomes small, its coercive force will improve. On the other hand, if thetamin is small, since average inclination becomes large and most columnar-grain children are vapor-deposited at high efficiency, a columnar-grain child's path becomes near uniformly, among each columnar-grain child, it will become difficult to produce an opening and a precise film will be obtained. For this reason, since coercive force of the top layer can be made high and coercive force of the bottom of the heap can be further made low relatively if thetamin at the time of top layer vacuum evaporation and bottom-of-the-heap vacuum evaporation is considered as the above-mentioned relation, a wide band can be covered, a magnetic parametric performance can be raised, and, moreover, the corrosion resistance of the bottom of the heap can be raised. In this case, as for especially thetamin at the time of top layer vacuum evaporation, it is preferred that it is 31 to 60 degrees 20 to 60 degrees, and, as for especially thetamin at the time of bottom-of-the-heap vacuum evaporation, it is preferred that it is 10 to 30 degrees 10 to 50 degrees. If it is the relation which thetamax at the time of bottom-of-the-heap vacuum evaporation and thetamax at the time of top layer

vacuum evaporation described above in this case, a magnetic parametric performance and corrosion resistance will become still higher.

[0040]And in above-mentioned each case, when the sum total of thetamax at the time of ferromagnetic metallic thin film vacuum evaporation of the top layer and thetamin is larger than the sum total of thetamax at the time of bottom-of-the-heap vacuum evaporation, and thetamin, higher corrosion resistance and a magnetic parametric performance are realized. In this case, as for especially the sum total of thetamax of the top layer, and thetamin, it is preferred that it is 116 to 150 degrees 100 to 150 degrees, and, as for especially the sum total of thetamax of the bottom of the heap, and thetamin, it is preferred that it is 70 to 114 degrees 41 to 139 degrees.

[0041]When considering it as a magnetic layer of multilayered constitution, it is preferred to have a two-layer ferromagnetic metallic thin film in which a direction into which ferromagnetic metal enters crosses on both sides of a normal of a nonmagnetic base. What is necessary is to make a running direction of a nonmagnetic base reverse and just to perform slanting vacuum evaporation, in order to form such a two-layer ferromagnetic metallic thin film. It is preferred that it is the top layer and its adjacent layer, or they are the top layer and a layer which sandwiches one layer and adjoins the top layer as two-layer [in this case]. By having such composition, the top layer and other one layer can be made into

respectively suitable coercive force for high band signal record and low-pass signal record, the whole region is covered, and a magnetic parametric performance improves.

[0042]What is necessary is for there to be no restriction in particular in the number of laminations of a ferromagnetic metallic thin film, when considering it as multilayered constitution, and just to choose composition of two-layer, three layers, or four layers or more according to the purpose. When considering it as multilayered constitution of three or more layers, the interlayer who exists between the top layer and the bottom of the heap should just design suitably a growth direction of thetamax at the time of vacuum evaporation, thetamin, thickness, and a columnar-grain child, etc. in consideration of various conditions, such as a frequency band of a record signal, and thickness of each class, so that optimal coercive force and corrosion resistance may be acquired.

[0043]In order to raise the corrosion resistance of a magnetic layer, a small amount of oxygen may be made to contain near the surface of each ferromagnetic metallic thin film etc. if needed.

[0044]As for thickness of each ferromagnetic metallic thin film, it is preferred that it is about 400-1000A. If thickness of the top layer becomes thinner than 400A, for example, record of an about 7.0-MHz high band signal will fully become impossible, and an output will decline. On the other hand, if it becomes thicker

than 1000A, noise will increase and a signal to noise ratio will fall. As for thickness of the whole magnetic layer, it is preferred that it is more than 2000A. Thereby, an output in low-pass [about 0.75-MHz] can be enlarged enough. In order to obtain high power on low-pass and both sides of a high region, it is preferred that thickness is increasing from the top layer towards a lower layer.

[0045]It is preferred that various topcoat layers publicly known for protection of a magnetic layer and corrosion-resistant improvement are provided on a magnetic layer of magnetic tape of this invention. In order to secure performance traverse when it tape-izes, it is preferred that publicly known various back coat layers are provided in a magnetic layer and an opposite hand of a nonmagnetic base.

[0046]

[Example]Hereafter, the concrete example of this invention is given and this invention is explained still in detail.

[0047][Example 1] The magnetic tape sample shown in the following table 1 was produced.

[0048]As a nonmagnetic base, the 8-micrometer-thick polyethylene terephthalate film was used.

[0049]The ground film was formed in the nonmagnetic base surface by the plasma polymerizing method. On the occasion of the plasma polymerization, it was considered as reaction pressure 0.1Torr, the frequency of 13.56 MHz, and

the output 200W, using methane as monomer gas. The thickness of the ground film of each sample is shown in Table 1.

[0050]The moisture transmission quantity of the nonmagnetic base after ground film formation is shown in Table 1. Moisture transmission quantity was measured as follows. First, A1 moisture-permeation cup was filled up with the calcium chloride as a drier, the nonmagnetic base in which the ground film was formed was placed on the cup, the cup was covered with the ** can board, and it fixed by metal fittings. Subsequently, neglected the cup in the homoiothermal constant humidity warehouse of 60 ** and 90%RH for 24 hours, the drier in a cup was made to absorb the steam which penetrated the nonmagnetic base and the ground film, and the weight change of the cup was measured.

[0051]The magnetic layer of each sample was constituted from a two-layer ferromagnetic metallic thin film, and the upper layer and a lower layer were formed as follows.

[0052]In the vacuum chamber, from the supply roll, it lets out a PET film, and it was mated and moved to the peripheral surface of the rotating cylindrical cooling drum, slanting vacuum evaporation of the ferromagnetic metal was carried out, the lower layer was formed, and it rolled round to the winding roll. Subsequently, this winding roll was used as the supply roll, and across the normal line direction of a nonmagnetic base, slanting vacuum evaporation of the ferromagnetic metal

was carried out, and it was considered as the upper layer in the incidence direction at the time of the above-mentioned slanting vacuum evaporation, and the crossing incidence direction. The thickness of the lower layer of each sample and the upper layer made the presentation of 900A, a lower layer, and the upper layer 80 atom %Co-nickel, respectively. thetamax at the time of vacuum evaporation made the upper layer and a lower layer 90 degrees, and thetamin made the upper layer and a lower layer 30 degrees.

[0053]On the occasion of lower layer ferromagnetic metal thin film forming, the mixed gas of Ar gas and O_2 gas was passed in the vacuum chamber, and the pressure in a vacuum chamber was maintained at 10^{-4}Torr. Mixed gas was passed so that the base of the portion vapor-deposited near a minimum incident angle might be sprayed.

[0054]The nonmagnetic base was judged and tape-ized to 6-mm width in the slitting machine after vapor-depositing a ferromagnetic metallic thin film, and it was considered as the sample.

[0055]A following inspection and measurement were performed about each sample. A result is shown in Table 1.

[0056](1) After saving crack inspection each sample for two months by 25 ** and 50%RH, the tension of 40 g per mm in width was impressed in the length direction of each sample. The magnetic layer surface after tension impression

was observed with the optical microscope, and the crack of the magnetic layer was inspected.

[0057]The valuation basis was carried out as follows.

O: x in which the length of the magnetic layer cross direction exists only in a crack of 0.5 mm or less : the crack which connects magnetic layer cross direction both ends exists.[0058](2) Rate-of-change **Bm [as opposed to / measure the maximum magnetization Bm for **Bm measurement each sample after one week preservation in the environment of 60 ** and 90%RH, and / early Bm] [%], It asked by [**Bm=(after [Bm] initial Bm-preservation) x100 / initial Bm].

[0059]

[Table 1]

表　1

サンプル No.	下地膜厚さ (A)	水分透過量 ($g/m^2 \cdot 24hr$)	クラック	ΔBm (%)
1	500	50	○	7
2	1000	30	○	5
3 (比較)	50	100	×	25
4 (比較)	なし	200	×	28

[0060]The effect of this invention is clear from the result shown in Table 1.

[0061]

[Effect of the Invention]Since width is 7 mm or less, the magnetic tape of this invention can be used as a very small cassette tape. And when it is considered as a tape with narrow width, generating of the big crack which connects the both ends of the magnetic layer cross direction which poses a problem is prevented.

[Translation done.]